Final: November 18, 2002

Notes from
Hydrology Component Breakout Session
Red River Valley Water Supply Project
Technical Team Meeting – September 10, 2002

Hydrology Breakout Attendees

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Hydrology Session Facilitator: Amy Lieb

Discussion Topics:

Hydrology SPOS

The major changes in the Hydrology Specific Plan of Study (SPOS) were described to members of the group to reiterate what was presented during the PowerPoint presentation to the entire technical team. A. Lieb inquired whether anyone had any questions, and no questions were asked. The comment period was set to end on September 27, 2002, and there were no objections to this deadline. Comments should be sent to Signe Snortland of Reclamation.

Water Quantity Model Selection Criteria

A preliminary draft matrix of model selection criteria was presented to the group for review and comment. The criteria were develop using required capabilities formulated originally by the Red River Modeling Stakeholders as noted in a ND State Water Commission memo dated February

11, 1997 for modeling of the Red River Valley. This memo is available from Reclamation by request. Model Selection Criteria for the Red River Project were also identified from the "Evaluation of Existing Water Availability Models" completed by the Texas Natural Resource Conservation Commission (TNRCC) on December 10, 1998, which is available at http://www.tnrcc.state.tx.us/permitting/waterperm/wrpa/tp2.pdf. A comprehensive list of water quantity model selection criteria was completed by using personal Red River Valley modeling expertise to formulate additional criteria. Four categories of model selection criteria were identified by the TNRCC in their evaluation which will be used in the Red River Project: Water Rights criteria, Functionality criteria, Operational criteria, and Information Technology (IT) criteria.

A potential model evaluation process was described to the group in order to outline the final product needed from this hydrology breakout session. The potential model evaluation process will use two categories associated with each model selection criteria called "importance" and "required or desired". The evaluation process will use a matrix to rank each model against each criterion. For each criterion, a score will be given to each model based on how well that model satisfies each criterion, (from 1-10). The "importance" and "required or desired" value associated with each criterion will be used as scaling or multiplication factors to insure that the important and required abilities of a model will be given more weight when compiling a total score for that model. Therefore, the final product of this meeting was identified as being a list of criteria with an importance of high, medium, or low associated with each criterion, as well as a rating of "required" or "desired". The list of original criteria is attached to these notes and changes agreed to by members of the group are denoted in red.

Members of the group discussed each criterion and whether the specified purpose, "importance", and "required or desired" values were sufficient:

Water Rights Criteria

- Doctrine, Western & Eastern: OK as is.
- Use Category: OK as is.
- Supplemental Rights: J. Paczkowski said water rights are never added onto in ND, but L. Kramka said this practice does happen in MN. In ND, if additional rights are requested and agreed to the by SWC, then they are made into a separate right given the priority date associated with when the additional water was requested. T. Bellinger explained this criterion gave more convenience to the model, but was not necessary to complete modeling. Members of the group agreed to change the importance level from high to medium and to make it a desired criterion and not required.
- Project vs. Non-Project Rights: T. Bellinger explained the ability to segregate between the project-related water and non-project water, e.g. baseflow, would help with keeping track of and allow targeting of reservoir storage water, diversions, return flows, and water originating out of basin. He simply wants the ability to color the water and direct where it goes in the system. Members of the group allowed this criterion to be required and of high importance.
- Storage Allocation Rights: OK as is.
- Monitor instream flow objectives/requirements: L. Kramka asked whether there is a need to identify and monitor streamflow levels necessary to dilute wastewater effluent. Members of the group agreed that the monitoring of flow levels needed to dilute effluent is a necessary model criteria and that at a minimum would identify times when additional treatment of water is

necessary by wastewater treatment plants before disposing of effluent in surface water systems. This criterion is also necessary to identify impacts to aquatic habitat in surface water systems. Members of the group agreed to generalize the purpose statement by removing the example of the quality of flow at the Canadian border, as well as upgrading the importance from medium to high and making this a required criterion.

Functionality Related Criteria

- Simulate movements of surface water: OK as is.
- Model diversions from and inflows to river and reservoirs at many locations: OK as is.
- Simulate location and magnitude of shortages: OK as is.
- Model based on a maximum of monthly time step: OK as is.
- Model also uses shorter time steps than monthly: Members of the group agreed that shorter time steps will be necessary, but the ability to do a daily time step is not necessary when completing the monthly modeling. Members of the group agreed this should be considered desired and not required.

* From this conversation, members of the group also decided that any criterion given an importance value of high is important to them and that even though each one of these criteria may not be able to be satisfied with one model, these criterion should be addressed somewhere in the Red River Project, if not in the modeling. More than one modeling effort may be completed to satisfy all "high/required" criteria.

- Simulate diverse alternatives: OK as is.
- Uses streamflow records and large numbers of them: OK as is.
- Models river gains and losses by reach: Members of the group discussed the idea of incorporating groundwater interaction and bank storage into a "reach efficiency" criterion, since we are looking at the entire basin and these types of ground and surface water interaction are most easily identified in a specific reach of the river system. Members of the group agreed to replacing groundwater interaction and bank storage with the reach efficiency criterion and making it required with a medium importance value.

Operational Related Criteria

- Simulate these specific reservoir operations:
  - *Elevation-Area-Capacity Relationships*: OK as is.
  - *Stage-Discharge (uncontrolled & controlled spillways)*: OK as is.
  - *Min & Max Elevation*: OK as is.
  - *Elevation & release targets*: OK as is.
  - *Evaporation losses*: OK as is.
  - *Capacity losses due to sedimentation*: Members of the group agreed this type of work is usually done outside of the modeling, so the importance level should be downgraded to medium (from high) and deemed only desired.
- Reservoir Multiple Use accounting: OK as is.

* New Criterion: Non-normal operation plans: Members of the group agreed that the ability to deviate from normal operation plans during times of low flow or drought could be useful. Members of the group did not decide on an importance value or whether it was required or desired since the meeting had to end.

Information Technology (IT) Related Criteria were not discussed due to lack of time. Members of the group decided to review the preliminary IT list for water quantity criteria and provide comment on it by September 27, 2002. Reclamation (A. Lieb and T. Bellinger) agreed to create a separate and more comprehensive water quality criteria list and to send it out to the technical team for review. At this time, members of the group did not want a separate Hydrology breakout session before the next Red River Project Technical Team meeting.

Action Items:

1. Any comments or corrections to the Hydrology SPOS should be sent to Signe Snortland at ssnortland@gp.usbr.gov by September 27, 2002.
2. Reclamation will compile a new version of the water quantity model selection list, as well as a more comprehensive water quality list, and distribute to the entire Technical Team.
3. Everyone should review and comment on model selection criteria by September 27, 2002 for water quantity. Water quality criteria should be reviewed, and a comment deadline will be established by Reclamation.
4. Reclamation will draft a model evaluation process to be reviewed at the next Technical Team Hydrology breakout session.

Water Quantity Model Selection Criteria

CATEGORY: Water Rights Criteria	Purpose for Study	Importance	Required or Desired?
Doctrine---Western: Appropriation (first in time, first in right) & Eastern: Riparian.	Model needs to account for various operating plans of reservoirs, alternatives and water users--it is not certain that specific water rights modeling is needed.	High	Required
Use Category: Municipal, Industrial, Irrigation.	Model needs to distinguish between sectors of use. Minimum needs are that it be able to segregate Municipal/Industrial and Irrigation	High	Required
Supplemental Rights: Add on to an original water right.	Model needs to be able to split water rights ~~or add on to rights~~ with differing priority dates (I.e. due to additional acreage added to the same diversion.	~~High~~ Medium	~~Required~~ Desired
Project vs Non- Project Rights	~~(Model needs to be able to segregate Project (Storage) rights from Non-Project (natural) flow rights and be able to distinguish and segregate return flows from the use of those rights.)~~ The model needs to have the ability to segregate and target individual project water supplies from non-project water supplies, e.g. baseflow, with respect to storage, streamflow, return flow, water rights and imported supply.	High	Required
Storage Allocation Rights	Model needs to be able to allocate storage in a reservoir to specific water rights and priority dates.	High	Desired
Monitor instream flow objectives/requirements (instream flow rights)	Model needs to simulate operating plans that allocate a certain portion of the river flow to instream flow requirements.	~~Medium~~ High	~~Desired~~ Required

CATEGORY: Functionality Related Criteria			
Simulate movements of surface water (mass balance accounting not dynamic routing)-	Needed to evaluate past, present and future water management and development effects upon streamflow conditions and alternative water supply solutions.	High	Required
Model diversions from, and inflows to river & res. system @ various locations	Model needs to account for quantity and quality of inflows and outflows.	High	Required
Simulate the location and magnitude of water shortages	Need to know the location and magnitude of shortages so alternatives can be evaluated/sized.	High	Required
Model based on a maximum of a monthly time step.	Monthly time steps may be adequate for analyzing water supply scenarios, longer time steps are less useful.	High	Required
Shorter time steps than monthly.	Monthly time steps may not be adequate for analyzing aquatic impacts or brief shortages. A daily time step could be used.	High	Desired
Simulate & input a number of diverse alternatives(no solution, in-basin, out-of-basin)	The model needs to be capable of simulating alternatives.	High	Required

Water Quantity Model Selection Criteria

CATEGORY: Functionality Related Criteria(cont.)	Purpose for Study	Importance	Required or Desired?
Able to use streamflow records and capable of handling large historical or stochastic streamflow databases	**Modeling will be based upon surface water flow records rather than rainfall-runoff or full water budget methods.**	**Medium**	**Desired**
Model river reaches gains & losses--	**Losses & gains need to be subtracted or added to river quantities to represent the system.**	**High**	**Required**
Routing	**Model needs to be capable of simulating gains and losses that migrate between various nodes.**	**High**	**Required**
~~**Groundwater interaction** (see Reach Efficiency)~~	~~**Model needs to account for inflow/outflow of groundwater.**~~	~~**High**~~	~~**Required**~~
~~**Bank storage** (see Reach Efficiency)~~	~~**Model needs to account for storage of groundwater in the aquifers connected to the channel (in the soil adjacent to the channel).**~~	~~**Medium**~~	~~**Desired**~~
Reach Efficiency	**Model needs to be capable of generally simulating gains and losses that occurs between various nodes due to groundwater interaction and bank storage.**	**Medium**	**Required**
Ungaged watersheds or minor tributaries	**Model needs to account for inflow from tributary areas between gaging stations.**	**High**	**Required**

CATEGORY: Operational Related Criteria			
Simulate main-stem, & off stream reservoir operations using:	**The model needs to simulate reservoir operation plans so the impacts of reservoir operations can be determined.**	**High**	**Required**
Elev.-Area-Capacity Relationships	Impacts of reservoir operations.	**High**	**Required**
Stage-Discharge (uncontrolled & controlled spillways)	Impacts of reservoir operations.	**High**	**Required**
Min, Max elevation	Impacts of reservoir operations.	**High**	**Required**
Elev. & release targets (normal, flood operations)	Impacts of reservoir operations.	**High**	**Required**
Evaporation losses	Losses due to reservoir storage/operations.	**High**	**Required**
Capacity losses due to sedimentation	Losses of storage over time due to reservoir sedimentation.	~~**High**~~ **Medium**	~~**Required**~~ **Desired**
Accounting for reservoir multiple use storage allocations	**Model needs to simulate multiple-use (complex) reservoir operating plans.**	**High**	**Required**
Deviate from normal operating plans in low flow periods	**The ability to deviate operating plans of reservoirs in low-flow times could be used to simulate any drought contingency plans.**	**High?**	**Desired?**

Water Quantity Model Selection Criteria

CATEGORY: Information Technology Related Criteria	Purpose for Study	Importance	Required or Desired?
Minimal Training	Model needs to be user friendly so that excessive learning curves are avoided.	High	Desired
Adequate Model Documentation	The model should be well documented with respect to computational methods used, assumptions, user input requirements, and error checking/troubleshooting methods.	High	Required
Graphical User Interface	Input of data to the model needs to be convenient.	Medium	Desired
User support capabilities	Support for the users is important.	High	Desired
The model is presently developed and has been used for similar studies elsewhere.	Model has successful track record and is generally accepted by professionals for similar work.	High	Required
Software has current and accurate user Manuals(input, errors)	Reduces learning curve and improves likelihood of successful modeling.		Desired
Intel processor with windows, 95, NT, DOS	PC's are in widely used and universally available…access to other operating systems and mainframe computers is less widespread.	Low	Desired
Non-proprietary or one-time fee models are preferred.	Fees to use model need to be avoided or minimized.	High	Desired
Input: Ability for the model to utilize both flat files or database structures for input/output.	Flexibility of the model to import or use various input formats would add convenience to model set up.	Medium	Desired
Output---tabular report, time-series graphs	Model output needs to be in a convenient form for presentation and data analysis. The ability to output data in to various formats is integral.	High	Desired
Peer acceptability	Model is generally accepted by professionals for similar work.	High	Required
Method for evaluating model error(sensitivity analysis)	Model needs capability for sensitivity analysis.	High	Desired
Reproduce stream flow records based on past demand input	The ability to calibrate the model and reproduce observed results builds confidence in the model results.	High	Required
Model ownership and ability to manipulate code	The ability for the user to be able to modify the model code for specific conditions or for tailoring the model to a unique component of the basin operations is occasionally important in generally applied "off the shelf" models.	Medium	Desired
GIS Capabilities	The ability of the model to interface with GIS could allow for better presentation of results and processes.	Medium	Desired